BIRDS AND ECOLOGY

BY

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1. WHAT IS ECOLOGY?

Ecology is the study of plants and animals (in the widest sense) in relation to their surroundings. It is in the meaning to be given to the term 'surroundings' that the real extent of the subject lies. One is inclined to think of surroundings as 'just a bit of jungle', as though it were quite fixed and subject to no change; but we must think of them instead as consisting of the earth on which the jungle grows and the rocks under the earth, as well as the atmosphere whose warmness or coldness and humidity influence the type of plants growing in the jungle, if we are to understand the relationship at all. This larger conception of the surroundings is referred to as a 'habitat', and the study of the habitat is the foundation of all ecological work. The ocean is just as much a habitat for the whale, and the body of the host is just as much a habitat for the parasite, as the jungle is for a tiger or a bird.

Having determined and described the habitat, the next logical step is to catalogue exhaustively the plants and animals and other livestock to be found there. In a full ecological survey this is done by the collection of specimens, and this is the only satisfactory way in which the identity of many species can be established beyond doubt. It is, however, still possible to do useful work without the collection of specimens. The fauna and flora having been adequately catalogued the way is open for the more interesting and complex aspects of the full survey—the study of the inter-relationship of animals and plants among themselves, the effects of changes in their environment brought about by such matters as changes in the food supply, by drought, flood and disease, and so on. There are many more factors which need not be mentioned here, for there will be few amateurs who are able or qualified to carry out work of such detail and complexity in such a way as to satisfy the scientists; for true ecology is rapidly becoming a science. To investigate fully the structure of a community and the effects on that community of the many variable factors which may play upon it, needs advanced scientific training, a good deal of equipment, the co-operation of other experts, and an abundance of time and patience.

In view of the difficulties which attend a full ecological survey of any natural community, it is not surprising that a good deal of attention has been given, particularly in Europe and America, to more limited aspects of ecology. Many enquiries have now been undertaken either into one particular subject such as the habits and habitats of Antarctic whales, or the fisheries of the North Sea, or to answer some particular question such as the enquiry undertaken in the British Isles during the recent war to find out just what damage was done to crops by Wood Pigeons (*Columba palumbus*). On the medical side there are the well-known investigations of Ross into the activities and life-history of the

malaria-carrying *Anopheles* mosquito, and similar investigations on the fleas carrying bubonic plague. Properly controlled enquiries into selected subjects are of the utmost importance to mankind.

It is not quite so easy to see just how investigations into the ways and habits of birds can benefit man in any material sense, but it must be remembered that this is as yet almost a virgin field which on close study may well reveal causes and effects hitherto quite unsuspected. A few years ago it was thought that the Starling (*Sturnus vulgaris*) was responsible for carrying foot and mouth disease to Great Britain from the Continent of Europe, though the general opinion today seems no longer to support this view. And birds are certainly responsible for the distribution of the seeds of many trees and plants. There are many examples of the converse, of the effect of man's activities on birds. One of the most striking and well-known is that of the Corncrake (*Crex crex*) which was common in the hayfields of England in the last century. The introduction of earlier seeding grasses for the hay and of mechanical reapers has so reduced the acreage of grassland suitable for it to nest in that this is thought to have contributed largely to the decline of the Corncrake in many parts of England to-day.

2. The Study of Habitats

There is much useful work which can be done by the amateur who has neither the qualification, nor the time, nor the inclination to join with others in a full ecological survey. In the forefront is the study of habitats.

Plant ecology got away to a much earlier start than did animal ecology, and the geographers and plant ecologists have worked out from a mass of observations the major vegetation types for most of the world. The kinds of plants and trees that will grow in any particular place depend on many physical factors, such as the suitability of the soil and the climate. Palm trees, for instance, can grow only within certain limits of heat and humidity, and where these limits are passed, either through distance from the equator, elevation or dryness of the soil, no palms are to be found. The limits of their range can therefore be plotted fairly accurately on a map.

In the delta area of Bengal are large areas of land devoted to the growing of paddy and jute, liberally interlaced with patches of mixed jungle. If the species of plants and trees to be found in these areas are compared with those growing in the Irrawaddy Delta, some 500–600 miles away, they are found to possess many common characteristics, one of the major ones being that they require a great deal of moisture. Further to the west of the Bengal delta region, where the south-west monsoon does not carry quite such a heavy rainfall, the plant associations are all of a kind requiring less moisture for their support. By careful comparison of the plant associations in different parts of India, combined with a study of the geology and soils and particularly of the climatic conditions, it has been possible to plot on maps the areas where the plant associations have enough common characteristics to be considered as belonging to one particular type of vegetation. In each of these general types certain kinds of plants and trees are found to be dominant. And in each of them will be found many different local or minor associations possessing recognisable characteristics of their own, in each of

which different kinds of plants and trees may be dominant. We speak, for instance, of teak forest or a mango or palm grove, when the dominant trees are teak or mangoes or palms; but other plants and trees are nearly always to be found in the same association, though to a lesser extent than the dominant species.

In the study and analysis of the birds to be found in these minor and major plant associations or habitats there is a great deal of scope for the bird-watcher. That different associations of birds are to be found in different habitats is almost an axiom. Compare the birds to be found in an extensive bamboo brake with those of the luxuriant Bengal jungle, with its rich undergrowth, or those of a Himalayan pine or rhododendron forest, and they will be seen to be quite different. Some species, however, may occur in each and much has still to be learnt about the exact habitats in which any given species can be found and the use to which each is put.

E. M. Nicholson in 'The Art of Bird Watching' (Witherby, London, 1931) has compiled a tentative classification of the types of habitat occurring in the British Isles, and with patience and co-operation from others his method could quite well be applied to the habitats to be found in any part of the world. Broadly he divides all habitats into certain major categories, e.g. a Coastal Group, an Inland Water Group, a Mountainous and Waste Land Group, (in India this could more satisfactorily be divided into two separate groups), a Woodland Group, a Cultivation Group, and a Civilisation Group. These main groups are subdivided. The Coastal Group, for instance, is composed firstly of the different kinds of rocky beaches, secondly of the various kinds of beaches without rocks, and thirdly of miscellaneous types such as sand dunes, salt marshes and so on. Each of these minor habitats is given an index number composed of a letter referring to the class of habitat and a number referring to the specific type of habitat. The following is an extract from his Coastal Group:

Rocky beach, with precipitous chalk cliffs.	
Type: Beachy Head, Sussex	A 2
Rocky beach, with Devonian cliffs.	
Type: Baggy Point, Devon	A 5
Shingly beach, without cliffs.	
Type: Pevensey Bay, Sussex	B 2
Muddy or sandy beach, without cliffs	B 3
Sand dunes	C 1
Salt marsh.	
Type: Wells-next-the-Sea, Norfolk	C 6

In this paper I include India, Pakistan and Burma in the title 'India' for the sake of brevity; after all, birds can hardly be expected to recognise political boundaries. A larger number of major vegetational regions is represented in India than in the British Isles, and in applying Nicholson's system to Indian habitats it would probably be helpful to prefix a second index letter to signify the major vegetational region concerned.

H. G. Champion (1936) has worked out a comprehensive provisional classification of forest types occurring in India based on four temperature zones, tropical, sub-tropical, temperate and alpine, each

subdivided according to moisture conditions as reflected by the relative importance of evergreen, deciduous and thorny trees. His main divisions are as follows :

Moist Tropical Forests.

Group 1. Tropical Wet Evergreen Forests.
Group 2. Tropical Semi-evergreen Forests.
Group 3. Tropical Moist Deciduous Forests.

Dry Tropical Forests.

Group 4. Tropical Dry Deciduous Forests.
Group 5. Tropical Thorn Forests.
Group 6. Tropical Dry Evergreen Forests.

Montane Sub-Tropical Forests.

Group 7. Sub-tropical Wet Hill Forests.
Group 8. Sub-tropical Pine Forests.
Group 9. Sub-tropical Dry Evergreen Forests.

(*Montane*) *Temperate Forests.*

Group 10. Wet Temperate Forests.
Group 11. Himalayan Moist Temperate Forests.
Group 12. Himalayan Dry Temperate Forests.

Alpine Forests.

Group 13. Alpine Forest.
Groups 14 and 15. Alpine Scrub.

These groups he subdivides into their various characteristic components and he also lists the subsidiary edaphic and seral types occurring in each main group. Anyone proposing to undertake any ecological work which involves jungle of any description would do well to study this paper beforehand and to decide into which category the jungle concerned falls.

Champion's classification covers only the forest types and it would be a very useful preliminary to future ecological work if an exhaustive (even if only tentative) classification could be made of all other main habitat types occurring in India, and approved by some body of standing in order to minimise the risk of confusion in later comparative work.

3. Habitat Surveys

Although information is needed on all kinds of habitats, one should, in selecting a habitat for survey, choose one that can be covered adequately with the resources at one's command. A patch of jungle may appeal as containing more kinds of birds than are found among paddy-fields, and therefore being on the face of it more interesting, but it is infinitely more difficult to survey it adequately. Until one has worked out one's own technique on easier habitats it is

wiser not to attempt a comprehensive survey of so difficult a subject as jungle or scrub if one is aiming at detail and accuracy, as the results will probably be neither accurate nor complete and may well be misleading.

It is advisable to select a habitat that is characteristic of other districts as well, so that it may be used for comparative work later on, though surveys of isolated and non-recurring habitats are still valuable in view of the paucity of records so far collected, particularly if it is one which is likely to disappear eventually. Another point to bear in mind is that what are natural boundaries to us may well be 'highways' or gathering points for the birds we wish to study. A hedge or a continuous line of bushes may be a serious obstacle for man (and therefore a convenient boundary to his activities) unless there are gaps through which he can pass, but it is likely to be the headquarters of many birds.

The type of habitat to survey must inevitably depend to a great extent on one's resources and qualifications and objects. If one is working with other specialists as a team with the object of undertaking an intensive and exact study of the structure of a community, one must of necessity choose a somewhat limited area. On the other hand, if one is working entirely alone and one's opportunities for field work are restricted or irregular, it is probably wise to limit one's object to compiling a comprehensive list of all the birds seen in the district. In this case a larger area can be covered, but one should be prepared to sub-divide it into its component minor habitats and to try to disentangle the real use to which each one is put by the birds seen there. If one moves about the country from time to time similar methods can be applied to each place visited and interesting comparisons can later be made between the various habitats covered. It is useful when doing this to work out a formula or 'pro-forma' for the form and order in which one's reports are to be couched, as this facilitates comparisons later on.

In carrying out a general survey of a larger area it will probably be found that it comprises certain minor features which cannot easily be separated as distinct habitats and these can be treated as part of the surroundings in which they stand, provided that this is made clear in one's records. In Bengal, for instance, the villages are liberally prinkled with tanks, which are the resort of kingfishers, pond herons and so on; the tanks are the chief attraction to these birds, though in their comings and goings they use the surrounding habitat in which the tanks stand, and many of the other birds living in the neighbourhood go to the tanks to drink and bathe. These tanks are so numerous and so small that it is very difficult to separate them satisfactorily from the surrounding habitat.

In studying any particular habitat the first thing to be done is to describe it fully and accurately, and in this it is a great advantage if the help of a competent botanist can be enlisted to describe the vegetation, an entomologist to deal with the insects, and of other specialists to cover such matters as the local climatic conditions, the fauna, and the soil and geology. A team of observers, each one competent in his own particular field, is ideal for any habitat survey, and the combined knowledge of such observers as are available may be sufficient to bridge the gap left by the absence of, say, a geologist. Even so, a lot

of useful work can be done by one man working on his own, provided he is observant, accurate and knows his own limitations.

Many features in any habitat change during the course of a year and full records should, of course, be kept of these as they may well affect the bird life. Plants come into flower and fruit, the leaves of some of them fall leaving the branches bare and a carpet of dead leaves on the ground beneath, which provides cover for insects; paddy is planted, flooded and harvested and all these changes may in some way or another influence the use to which the birds put the jungle or the paddy-fields. The metereological records should include temperatures, rainfall, humidity, wind, cloud and so on in order to provide a comprehensive record of the weather experienced during the survey period. Some animals are known to be seen more often in a dry season, some plants thrive and fruit better in a wet one, but we know little of the limits within which dryness and wetness are effective.

The natural complement to a full description of the survey area is a map or plan of it. More often than not it is necessary to prepare one's own sketch plan and this should be large enough to show all the important features clearly. If the survey area comprises more than one kind of minor habitat, these should be shown on the plan by means of different kinds of shading or hatching, or better still by the use of different coloured inks. The writer has found it very useful to give each prominent feature an identity number or letter. In studying a group of six fields, for instance, each field will be given a number, and the corners and centre points of each will be given a letter. This is much simpler than having to refer to 'the middle field on the eastern side of the area'; and it is easier and shorter to refer to 'Point A', or merely to 'A' rather than 'the south western corner of the north eastern field'. One can use one's time in the field more profitably in observing than in repeatedly writing down long terms which are constantly recurring, and provided one's records are accurate it does not matter how abbreviated a code one uses. In surveying small areas, where the number of species likely to be met with is not large, it is also useful to make a list of all the species one may reasonably expect to see there and to give each one a code number or letter. The key to this, with a small copy of the sketch plan, should be written down at one end of the field note book, so that one always has it with one for reference. It is surprising how quickly one evolves one's own code and learns it by heart.

Before embarking on any survey it is a good plan to formulate certain guiding 'rules'. Are you, for instance, going to include birds seen only flying over, and if so how are you going to refer to them in your notes and in your final report? How do you propose to deal with mixed hunting parties, which are only passing casually through the survey area? Are you going to attempt periodic counts of numbers? If so, they will require a special set of rules of their own. The making of censuses is outside the scope of this paper and anyone interested is advised to look up the reports of past censuses. Decide on these points before starting on the actual survey, so that your records may be consistent throughout.

Having selected the survey area, made a sketch plan of it, and written down a full description of the habitat, one can then begin a survey of the birds. If one is aiming at great exactitude and a

detailed result, the area should be inspected at frequent intervals preferably every day, and as far as possible one's visits should take place at the same time or times each day. This is not always possible, nor is it always essential if one is aiming only at a more general result. A small note-book should always be carried in the field and the observations entered in this during or immediately after the visit to the survey area; memory dulls one's observations very quickly and accuracy may often be lost in a matter of an hour.

Some years ago the writer carried out a survey of the birds on a farm in southern England through which he passed nearly every day on his way to and from the office; this survey lasted about six years. It was by no means an ideal survey as it had to be moulded to fit the conditions under which it was made. The method adopted was to give each field an identity number, and each prominent feature (including the centre point of each field) was allotted a code letter. Another series of code letters and numbers was used for the kinds of birds usually seen. The use of these codes very quickly became automatic and the saving in time and space was enormous. Having noted in the field note-book the date and hour of the visit, any agricultural operations which were taking place, the weather and any special incidental items, a short record was made of each species seen, its numbers wherever possible, and where seen. In the case of small birds, such as larks, it was quite impossible to estimate their numbers during the 10–15 minutes in the survey area, which was usually all that could be spared, and comments had to be in such general terms as 'a few', 'several', 'a flock of about 20 in Field I and a few in III', and so on. In the case of larger birds, such as Rooks (*Corvus frugilegus*), and Lapwings (*Vanellus vanellus*), an attempt was always made to count them, or at any rate to estimate their actual numbers, and it was surprising how quickly one learnt to give an estimate within about 5 per cent of the correct number. At the end of the survey, the records were analysed in an attempt to show the use made by the birds of each kind of cultivation, as well as the seasonal fluctuations. For the larger birds graphs were drawn for each species, based on the largest number seen each week, and these suggested an interesting annual rhythm in the numbers.

It is not always possible to carry out such an intensive survey as this and one must work out one's own technique to suit the circumstances. The habitat in the survey mentioned above was a simple one, consisting only of arable and pasture land covering about 150 acres, without the complication of any woodland. While serving in India during the recent war, when opportunities of bird watching and of writing up records were very irregular the writer adopted a different technique; this has already been shortly described in his paper on 'Some Bird Associations of Bengal'.

Whatever method be used for keeping records of the survey, it is important to evaluate one's observations in order to avoid giving a distorted impression to others. If one is not absolutely certain of the identity of a bird seen it is essential that this be made clear in the records. There are many occasions on which even the most experienced ornithologist is not absolutely certain beyond all doubt of the identity of the bird he has seen, and there is nothing to be ashamed of in confessing one's uncertainty. Here again the use of signs and symbols can save a lot of time and trouble. For example, a tick can be

used for a bird of whose identity one is positive; a star for one whose identity is uncertain; a cross for a 'possible' and so on. The same rule applies in recording plants and trees, animals and insects.

The records should always include a note of the time and conditions under which they were made, and of all incidental matters which might affect either the birds themselves or the validity of the record. Observations with the naked eye from a moving train or car are obviously more open to mistake and inexactitude than observations made with field glasses at only a few yards range. And the fact that aircraft are constantly taking off and landing at an aerodrome while observations are being made there may well affect the numbers and kinds of birds seen.

Although bird ringing was designed primarily to assist the study of migration, coloured rings can be a great help in studying a very small area. The British Trust for Ornithology (91 Banbury Road, Oxford, England) has published a very useful Field Guide (No. 1) on 'Trapping Methods for Bird Ringers' by P. A. D. Hollom[1], and this is well worth consulting by anyone who proposes to use ringing as an aid to a survey.

4. Other Surveys

Another method which can give useful results if properly organised and controlled, where a continuous survey is not possible, is the taking of thorough samples at longer intervals. The margin of error is, however, inclined to be greater than in a 'running survey' and there is a danger of missing trends.

Yet another method that can be usefully employed in habitat surveys is the transect. This is a detailed record of all birds seen on, say, a long train journey, or a voyage by boat up a river, or a long trek on foot. In each case, of course, an exact note is made of the habitat through which one happens to be passing at the time each bird is seen. Transect reports might have a good deal of value if there were a large number of them covering the same route at all times of the year, but their very nature is inseparable from incompleteness and inexactitude, though observations taken on a trek on foot will naturally be fuller and more accurate than those made from a moving vehicle.

In recent years some extensive surveys have been carried out into the distribution and habitats of particular species. The Lapwing Habitat Enquiry, organised by the British Trust for Ornithology in the British Isles in 1936 and 1937, is a good example. This survey was carried out by numerous observers all over Great Britain, who recorded their observations on special forms. The results were correlated and analysed by E. M. Nicholson (1939). The study of the habitats of a particular species or group of species would be an interesting task for someone with few restrictions on time or travel, but really a survey of this kind requires the co-operation of a large number of observers in different parts of the country, especially in so large a country as India, working under some central direction. A very useful preliminary would be the cataloguing of all the different habitats occurring there.

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[1] Noticed on p. 773 of Vol. 49 (4) of the *Journal*—April 1951.—Eds.

It sometimes happens that a river changes its course or a lake dries up, uncovering 'new' land which is bare of all vegetation. A somewhat similar thing happens when a hillside is scarred by a landslide. Plant ecologists distinguish between the two cases, but there is no need to do so here. Within a short time wind-blown seeds germinate on the new earth and these quickly cover it with an open vegetation with plenty of spaces between the plants. In another season these gaps will have been closed by the growth of the plants already established and the arrival of other seedlings, and then the struggle for existence really begins. If such an area is watched year after year it will be seen that the character of the vegetation changes as the plants become more congested and new layers of humus are added from the fallen and decayed leaves. One particular plant will succeed better than the others and will tend to crowd the others out. As time goes on the small first stage plants will be succeeded by larger plants and trees and eventually the climax vegetation (usually similar to that of the surrounding country) will be reached beyond which the succession does not go. Plant ecologists call this succession of vegetation a 'sere'. As the vegetation changes so the bird associations found there will change, and a complete survey through all the stages of a succession would be a most valuable contribution to ecology.

A rather similar kind of succession can be found where virgin jungle is cleared and the ground turned over to crops; or where a town is extended outwards into what had previously been countryside. Forest fires, earthquakes, landslides, prolonged flooding, extreme drought, plagues of insects and so on can all initiate a greater or lesser vegetational succession in which the sequence of bird associations is worth studying. Change is always taking place and the record of how any particular change affects the bird population is interesting and valuable.

In Bengal and other parts of India and Burma vast areas of paddy land are flooded every year as part of the regular cultivation of the crop. Flooding on such a large scale is certain to produce reactions among the avifauna of the districts affected and also the surrounding districts, and this is a subject which would be well worth organised study. Everyone keeping accurate records for his particular district would be making a valuable preliminary contribution.

Certain trees and crops prove an attraction for some birds. When the Red Silk Cotton trees (*Bombax malabaricum*) are in bloom, numbers of birds can be seen about the large flowers. Whether they are after the nectar, the dew collected in the cup of the blossom, or the insects attracted by the nectar is not known for certain, and this is a question which photography might well be able to answer. Probably the truth lies in a combination of all three, as not all of the many species of birds seen at the flowers are habitual insect-eaters. Whatever the attraction, there is no doubt that one of the results is that the birds assist in the pollination of the flowers. Many kinds of birds are also attracted by the tapping of toddy palms, but again whether by the liquid or the insects attracted by the liquid is not certain. Probably each is an attraction to certain kinds of birds. The writer has certainly seen a Tickell's Flowerpecker (*Dicaeum erythrorhynchum*) catching the drops of liquid as they fell.

Commensalism is another allied subject that has so far received

comparatively little attention. Cattle Egrets (*Bubulcus ibis*), mynas and wagtails can often be seen foraging about grazing cattle and it is known that they obtain benefit from doing so in the form of insects disturbed from the grass by the movements of the beasts. Just what benefit birds find from foraging or consorting together is less clear. What, for instance, is the underlying reason for small birds to join together in mixed hunting parties, or for Rosy Pastors (*Pastor roseus*), for instance, to join together in flocks of their own kind, outside the breeding season? Is the only reason that wagtails roost together the shortage of suitable roosting places? Why do birds nest and live in colonies like the Weaver Birds? These are all questions to which no final answer has yet been found.

5. Conclusion

Bird ecology is only in its infancy and there is enormous scope for experiment and research. Teams of observers, each one an expert in his own subject, are ideal for the full study of a limited area and the structure of the community inhabiting it, but a single watcher working on his own can still do a lot of useful work. The control of some central body directing the activities of numerous observers spread over the whole country is essential to the success of some kinds of investigation; in the British Isles this function is fulfilled by the British Trust for Ornithology. This central body should also act as a clearing and storage house for individual reports and records, even if they are never published, where they may be available for reference and comparison by other workers. In its present state almost any contribution to ecological knowledge is likely to be useful, provided only that it is accurate.

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